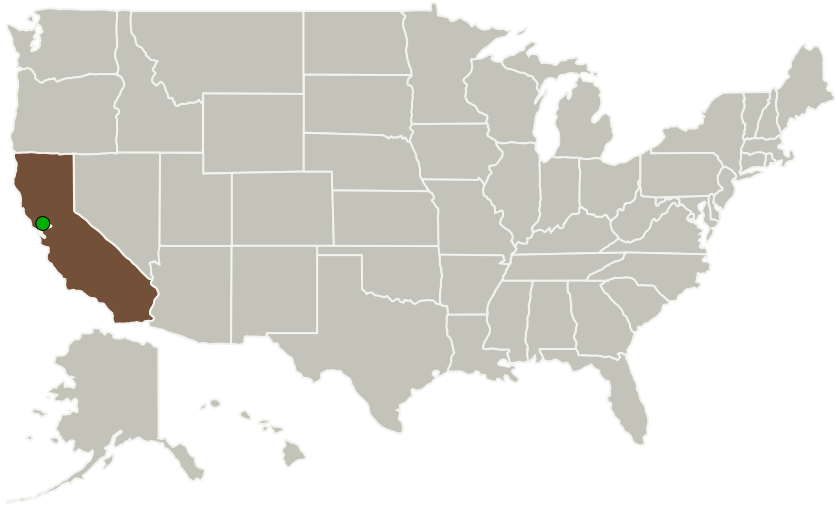
A Pulsed Nonlinear Raman Detection of Trace Organics with SERS Enhanced Sensitivity, Phase I

Completed Technology Project (2014 - 2014)

Project Introduction

A significant technology gap for NASA astrobiology missions is the detection of organics at the sub ppm level without sampling. Currently, NASA uses different sensing technologies such as Pyrolysis–GCMS to analyze planetary samples. These instruments require complex sample handling and can process only a limited number of samples. It is critical to develop an effective instrument with extended and enhanced capabilities to enable future planetary multiple-mission needs. We propose to develop a new nonlinear Raman spectral sensing technology for trace organic detection at the sub ppm level. The proposed technology will provide significantly increased sensitivity based on nonlinear Raman detection with Surface enhanced Raman scattering (SERS). It eliminates the sample preparation process, contamination and other related accessories. Our test samples will be soils from the Mojave, and Antarctic Dry Valley deserts which have measured organic concentrations of 10 to 250 ppm. We will mix unaltered soils with organics removed soils. The detection of organics at the sub ppm level without sampling will be applicable to several future NASA missions, in particular future rovers for the upcoming Mars 2020 mission. These mobile, fast and agile rovers are focused on collection for sample return and require non-sampling analytical instruments.

Primary U.S. Work Locations and Key Partners



A Pulsed Nonlinear Raman Detection of Trace Organics with SERS Enhanced Sensitivity Project Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Crystal Research, Inc.	Lead Organization	Industry	Fremont, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140577)*

Images

Project Image
A Pulsed Nonlinear Raman Detection of Trace Organics with SERS Enhanced Sensitivity Project Image
(https://techport.nasa.gov/image/130971)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Crystal Research, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Suning Tang

Co-Investigator:
Suning Tang

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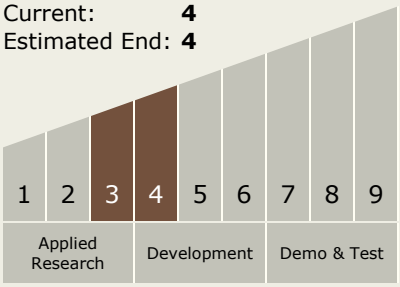
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System